September 3, 2014

The Honorable Andrew McAllister
Commissioner
California Energy Commission
1516 9th Street
Sacramento, CA 95814

Subject: California Energy Commission methodology for calculating the Savings to Investment Ratio for solar Power Purchase Agreements under the Proposition 39: California Clean energy Jobs Act - 2013 program

Dear Commissioner McAllister:

We the undersigned represent California-based businesses engaged either directly or indirectly in the provision of solar Power Purchase Agreements in California's public schools. It has recently come to our attention that there is a serious flaw in the methodology proposed by the California Energy Commission (CEC) for calculating the Savings to Investment Ratio (SIR) for solar Power Purchase Agreements (PPAs) under the Proposition 39: California Clean energy Jobs Act - 2013 program. As demonstrated in the attached analysis, this flaw puts solar PPAs at a severe and inequitable disadvantage relative to other energy efficiency and clean energy technologies. We believe the CEC's proposed method is inappropriate, inconsistent with the treatment of other energy and cost saving measures under Prop 39, and violates the statutes which provide direction to the CEC in implementing the Prop 39 program.

The issue with the CEC's proposed methodology has only recently emerged, as ambiguity in the language and formulas provided by the CEC relevant to calculating solar PPA SIRs has been further clarified by CEC personnel.[1] This clarification has unfortunately revealed a significant flaw in the CEC's approach which we believe must be immediately corrected. As it now stands, the CEC's solar PPA SIR formula double-counts the costs associated with the implementation of a solar PPA, resulting in a strong bias against PPAs in the Prop 39 program.

Approximately 40% of all of the solar capacity currently installed on public schools in California has been financed through solar PPAs. This important financing mechanism is particularly valuable for public schools, as it enables schools to benefit from federal tax credits which they are not able to receive directly. Solar PPAs also shift the burden for operating and maintaining the systems from the school to a qualified solar services provider, and ensure that a school will not pay for a non-performing solar power system.

[1] Ted Flanigan. July 2014. Climate Smart Schools {Proposition 39 Policy Brief #1: Qualifying Solar PPAs at California Schools.

In order to ensure that the full benefits of solar PPAs are available to Local Educational Agencies (LEAs) under the Prop 39 program, and to prevent the inadvertent stifling of growth in clean energy jobs providing solar PPAs in California, we recommend changing the CEC's SIR_{SPPA} from:

$$SIR_{SPPA} = \frac{NPV\ of\ LEA\ Cost\ Savings\ from\ PPA\ Discount}{NPV\ of\ LEA\ Electricity\ Cost\ Paid\ under\ PPA} \geq 1.05$$

to:

$$SIR_{SPPA} = \frac{NPV\ of\ LEA\ Electric\ Utility\ Cost\ Savings}{NPV\ of\ LEA\ Electricity\ Cost\ Paid\ under\ PPA} \geq 1.05$$

This change will correct the flaw illustrated in the attached analysis, and ensure that the cost-effectiveness of solar PPA's is measured as the statute intends and in the same manner as other energy efficiency and clean energy technologies.

Thank you for the opportunity to provide feedback on the Proposition 39 program, and for your thoughtful consideration in this matter. Please contact us with any questions or to further discuss the content of this letter.

Sincerely,

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Analysis: California Energy Commission's Proposition 39 Solar Power Purchase Agreement Savings to Investment Ratio Calculation

Background.

The California Clean Energy Jobs Act (Proposition 39) changed the corporate income tax code and allocates projected revenue to the General Fund and the Clean Energy Job Creation Fund for five fiscal years, beginning with fiscal year 2013–14. Under the initiative, roughly up to $550 million annually is available for appropriation by the Legislature for eligible energy projects such as energy efficiency upgrades and clean energy generation at schools. Over the next five years Proposition 39 will transfer an estimated $2.5 billion in new revenues to create clean energy jobs, reduce greenhouse gas emissions and save energy and costs for schools. Follow-up legislation (Senate Bill 73, Committee on Budget and Fiscal Review, Chapter 29, Statutes of 2013) allocated Proposition 39 funds to California's K–12 schools and community colleges, and codified the Energy Commission as the lead agency for the K–12 portion of the program.[2]

The statute requires that all Prop 39 projects "shall be cost effective: total benefits shall be greater than project costs over time" (PRC Section 26206(c)), and directs the CEC to establish guidelines for "methodologies for cost-effectiveness determination" (PRC Section 26235(a)(3)(D)). This basic direction is very clear – the legislature is defining cost effectiveness such that:

$$Total\ Benefits\ Over\ Time > Project\ Costs\ Over\ Time \qquad Eq.\ 1$$

or

$$\frac{Total\ Benefits\ Over\ Time}{Project\ Costs\ Over\ Time} > 1 \qquad Eq.\ 2$$

In response to this direction, the CEC has published program guidelines and other documents in which it defines a key metric of cost effectiveness for the program, the "Savings to Investment Ratio (SIR)", as "***the ratio of the present value savings to the present value costs of an energy efficiency measure or alternative energy generation***"[3]. The SIR is essentially the equivalent of the left side of Eq. 2 implied by statute.

The CEC provides the following basic equation for the calculation of the SIR:

$$SIR = \frac{NPV}{(Project\ Installation\ Cost - Rebates - Other\ Grants - Non\text{-}energy\ Benefits)} \qquad Eq.\ 3$$

where *NPV* is defined as the net present value of project cost savings:

$$NPV = Energy\ Cost\ Savings + Maintenance\ Savings \qquad Eq.\ 4$$

[2] California Energy Commission. May 2014. Proposition 39 The California Clean Energy Jobs Act Factsheet.
[3] Haile Bucaneg, Pierre duVair, Cheng Moua, Justin Regnier, Keith Roberts, Elizabeth Shirakh, Joseph Wang. 2013. Proposition 39: California Clean Energy Jobs Act –2013 Program Implementation Guidelines. California Energy Commission, Energy Efficiency Division. Publication Number: CEC-400-2013-010-CMF, p. I-3

In this *NPV* equation, the CEC defines *Energy Cost Savings* as the total present value of energy cost savings realized over the life of the equipment, including kWh energy, kW demand, natural gas, and other liquid fuel savings, (i.e., electric utility cost savings plus gas utility cost savings plus non-utility fuel purchase savings) and *Maintenance Savings* are defined as the present value of annual maintenance cost/savings attributable to the energy efficiency or clean energy measure (limited to 2% of the project costs). So the general *SIR* equation can be re-written as:

$$SIR = \frac{NPV\begin{pmatrix} Electric\ Utility\ Cost\ Savings + Gas\ Utility\ Cost\ Savings \\ + Non\ Utility\ Fuel\ Purchase\ Savings + Maintenance\ Cost\ Savings \end{pmatrix}}{(Project\ Installation\ Cost - Rebates - Other\ Grants - Non\text{-}energy\ Benefits)} \quad \textit{Eq. 5}$$

The CEC also clarifies that if "total project installation cost are greater than the Proposition 39 program award and additional financing is required, such as bond funds or private capital funds, this financing is to be considered part of the total project installation cost and is not deducted from the total project installation cost like a project rebate or other grant funding source."[4] While the CEC does not specify how these financing costs would be accounted for, it can be inferred that the NPV of financing costs should be added to the equation's denominator, so that the general *SIR* equation for a project which includes financing costs over time in addition to *Upfront Project Installation Costs* would read:

$$SIR = \frac{NPV\begin{pmatrix} Electric\ Utility\ Cost\ Savings + Gas\ Utility\ Cost\ Savings \\ + Non\ Utility\ Fuel\ Purchase\ Savings + Maintenance\ Cost\ Savings \end{pmatrix}}{\begin{pmatrix} Upfront\ Project\ Installation\ Cost + NPV(Project\ Financing\ Costs) - Rebates \\ -Other\ Grants - Non\text{-}energy\ Benefits \end{pmatrix}} \quad \textit{Eq. 6}$$

The CEC requires that SIR have a value of at least 1.05 in order to satisfy the legislative requirement that total benefits shall be greater than project costs over time. That is, "***For every dollar invested in the eligible energy project, the LEA will accrue $1.05 [or more] in savings***."[5] Conceptually, the SIR requirements for eligibility for Prop 39 funding can thus be written as:

$$SIR = \frac{Benefits\ over\ time}{Costs\ over\ time} = \frac{NPV\ of\ Every\ Dollar\ Saved\ by\ LEA}{NPV\ of\ Every\ Dollar\ Invested\ by\ LEA} \geq 1.05 \quad \textit{Eq. 7}$$

SIR for Solar PPAs.

A PPA is a financing option under which a vendor installs, owns and maintains the clean energy system (typically solar) on LEA property under a contract the LEA will purchase the electricity generated by the system. The LEA enjoys a reduction in electric utility costs (the benefit, or every dollar saved by the LEA), and the LEA pays for the clean energy system through electricity payments over the life of the contract (the cost, or every dollar invested by the LEA). The vendor owns, operates, and maintains the clean energy system for the life of the contract agreement at no additional cost to the LEA.

For solar PPAs, the CEC has put forth a special method for calculating SIR in an effort to reflect the inherent nature of PPAs (e.g., no LEA installation costs; LEA investment made over time in form of payments for clean electricity). The CEC's proposed solar PPA SIR equation is:

[4] Ibid, pp. E1-E2
[5] Ibid., p. 20.

$$SIR_{SPPA} = \frac{NPV\ of\ LEA\ Cost\ Savings\ from\ PPA\ Discount}{NPV\ of\ LEA\ Electricity\ Cost\ Paid\ under\ PPA} \geq 1.05 \qquad \textit{Eq. 8}$$

where *NPV of LEA Cost Savings from PPA Discount* is defined as the 'NPV of total energy cost savings realized over the life of the equipment', and *NPV of LEA Electricity Cost Paid under PPA* is defined as the 'NPV of total electricity cost paid to PPA developers over the life of the equipment'.[6]

The CEC has appropriately established the *NPV of Electricity Cost Paid under PPA* as the SIR_{SPPA} denominator in Eq. 8, i.e. the project costs over time or NPV of every dollar invested by the LEA.

The problem arises in the CEC's characterization of the *NPV of LEA Cost Savings from PPA Discount*, i.e. the numerator in the SIR_{SPPA} equation. Until very recently, this term, defined in the CEC program documents as the 'NPV of total energy cost savings realized over the life of the equipment', was widely understood by California's Prop 39 industry stakeholders to mean the NPV of LEA electric utility cost savings[7]. That is the only interpretation that makes sense in the context of a ratio of savings to investment whose purpose is to determine cost effectiveness – the savings (benefits) must be the **gross savings** (total benefits), and the investment (costs) must be the **gross investment** (total project costs).

However, it is now apparent that the CEC intends that the 'NPV of total energy cost savings realized over the life of the equipment' be calculated as the **difference** between the electric utility cost savings and the PPA electricity costs, rather than simply the electric utility cost savings (avoided utility costs). That is, the numerator in the SIR_{SPPA} equation is being calculated by the CEC as:

$$\begin{aligned} &NPV\ of\ LEA\ Cost\ Savings\ from\ PPA\ Discount \\ &\quad = NPV\ of\ LEA\ Electric\ Utility\ Cost\ Savings \\ &\quad - NPV\ of\ LEA\ Electricity\ Cost\ Paid\ under\ PPA \end{aligned} \qquad \textit{Eq. 9}$$

While the difference shown in Eq. 9 does result in a kind of net 'energy costs savings' (because PPA costs to the LEA are charged in dollars per unit of energy instead of simply dollars), this approach is NOT appropriate for calculating the numerator in the SIR_{SPPA} equation, since the *NPV of LEA Electricity Cost Paid under PPA* is also included as the cost in the equation's denominator. The **gross savings**, not the **net savings**, should be used in numerator.

As proposed, the CEC's methodology both subtracts the costs from the benefits in the numerator AND divides the resulting difference by the costs (the denominator), which in effect double-counts the costs. Substituting the CEC's equation for *NPV of LEA Cost Savings from PPA Discount* (Eq. 9) into the SIR_{SPPA} equation (Eq. 8) results in the following:

$$SIR_{SPPA} = \frac{NPV\ of\ LEA\ Electric\ Utility\ Cost\ Savings - NPV\ of\ Electricity\ Cost\ Paid\ under\ PPA}{NPV\ of\ Electricity\ Cost\ Paid\ under\ PPA} \qquad \textit{Eq. 10}$$

Since the SIR_{SPPA} must be greater than or equal to 1.05 to be deemed cost-effective, the right-hand side of Eq. 10 must also be greater than or equal to 1.05:

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[6] Haile Bucaneg, Joji Castillo, Cheng Moua, Joseph Wang. March 2014. Proposition 39: California Clean Energy Jobs Act –2013 Energy Expenditure Plan Handbook, Revised. California Energy Commission, Energy Efficiency Division. Publication Number: CEC-400-2014-002-ED2, p. 28

[7] Flannigan, p. 1

$$\frac{NPV\ of\ LEA\ Electric\ Utility\ Cost\ Savings - NPV\ of\ Electricity\ Cost\ Paid\ under\ PPA}{NPV\ of\ Electricity\ Cost\ Paid\ under\ PPA} \geq 1.05 \qquad \textit{Eq. 11}$$

which reduces to:

$$\frac{NPV\ of\ LEA\ Electric\ Utility\ Cost\ Savings}{NPV\ of\ Electricity\ Cost\ Paid\ under\ PPA} \geq 2.05 \qquad \textit{Eq. 12}$$

or:

$$\frac{Benefits_{SPPA}}{Costs_{SPPA}} = \frac{NPV\ of\ Every\ Dollar\ Saved\ by\ LEA_{SPPA}}{NPV\ of\ Every\ Dollar\ Invested\ by\ LEA_{SPPA}} \geq 2.05 \qquad \textit{Eq. 13}$$

Eq. 12 and Eq. 13 highlight the problem with the CEC's proposed method for calculating the SIR_{SPPA}. Because the costs are double-counted under the CEC's methodology by using a **net savings** rather than a **gross savings** in the SIR_{SPPA} numerator, the standard for cost-effectiveness for solar PPAs is roughly double what it is for all other eligible energy projects. That is, it requires that ***for every dollar invested in the eligible solar PPA project, the LEA will accrue $2.05 [or more] in savings,*** or ***the total benefits shall be greater than two times project costs over time.*** This is contrary to the direction of the statute and puts solar PPAs on dramatically unequal footing with other energy measures with respect to Prop 39 eligibility.

Example.

An example comparing basic project economics and SIR calculations of a solar PPA and an LEA purchase of a PV system will further illustrate the problem with the CEC's proposed SIR_{SPPA} equation. For this example, three scenarios are evaluated for the same system:

1. Cash purchase of the system, using all of the assumptions built into the CEC Energy Savings Calculator[8]
2. Purchase with financing and a long-term O&M agreement for the system in which 80% of the systems is financed over 20 years at 4%, and the O&M agreement provides for inverter replacement as well as system inspection, cleaning, and repair (typical of commercially available products); and
3. PPA financing for the system.

The economics resulting from these three scenarios are shown in the first table below. Project parameters for this analysis are shown in the second table on the following page. Note that in order to present a clear comparison focused on the disparity between the standard *SIR* and solar PPA SIR_{SPPA} calculations, in all scenarios where applicable the values used are those that are either a) hard-wired CEC Energy Savings Calculator assumptions (e.g., utility electricity cost escalation = 4%), or b) results calculated by the CEC Energy Savings Calculator (e.g., utility avoided electricity cost = 90% x average utility electricity cost). These CEC Energy Savings Calculator assumptions and results are identified by cross-reference to a key at the bottom of the table.

[8] Haile Bucaneg. May 16, 2014. Energy Savings Calculator, Version 5. California Energy Commission, Energy Efficiency Division.

	Cash Purchase	Purchase with Financing & O&M Contract	Power Purchase Agreement
Savings			
Electric Utility Cost Savings			
First Year	$ 35,395	$ 35,395	$ 35,395
Levelized Annual (20 Year)	$ 46,420	$ 46,420	$ 46,420
NPV (20 year)	$ 578,494	$ 578,494	$ 578,494
Maintenance Savings (Costs)			
First Year	$ (857)	$ (3,061)	$ -
Levelized Annual (20 Year)[+]	$ (7,826)	$ (3,602)	$ -
NPV (20 year)[+]	$ (97,533)	$ (44,887)	$ -
Subtotal NPV Savings (20 year)	$ 480,961	$ 533,607	$ 578,494
Costs			
Initial Cash Payment	$ (428,505)	$ (85,701)	$ -
Annual Payments (Loan or PPA)			
First year	$ -	$ (25,224)	$ (25,551)
Levelized Annual (20 Year)	$ -	$ (25,224)	$ (29,528)
NPV (20 year)	$ -	$ (314,348)	$ (367,969)
Subtotal NPV Costs (20 year)	$ (428,505)	$ (400,049)	$ (367,969)
Project Total NPV (NPV Savings+NPV Costs)*	**$ 52,456**	**$ 133,558**	**$ 210,525**
NPV $ Saved per NPV $ Invested	**$ 1.12**	**$ 1.33**	**$ 1.57**
CEC SIR	**1.18**	**1.41**	**0.82**

[+]Cash purchase scenario includes two inverter replacements in O&M costs (years 8 and 16), per CEC Energy Savings Calculator

*Does not include non-energy benefits

Scenario Analysis Results

These results highlight the flaw in the CEC's proposed SIR_{SPPA} calculation methodology. *Each scenario provides the same electric utility cost savings.* The PPA has the lowest NPV of costs, the highest project overall NPV, and the greatest ratio of NPV of dollars saved to NPV of dollars invested. It is the most cost-effective and economically best alternative of the three options for the LEA. However, due to cost double-counting error in the CEC's proposed SIR_{SPPA} formula, the PPA project would not meet the Prop 39 economic test hurdle and would not be eligible for Prop 39 funding, while both the cash purchase and financed scenarios would be eligible.

Parameter	Value
Benchmarking	
School Type	Elementary
Average Demand (kW)	350 kW
Electricity Purchase from Utility (kWh)	495,000 kWh
Total Annual Electric Charges ($)	$122,000
Average Utility Electricity Cost per kWh ($/kWh)*	$0.246/kWh
Avoided Utility Electricity Cost per kWh ($/kWh)*	$0.222/kWh
General Calculation Assumptions	
System Lifetime+ (yrs)	20 yrs
Annual System Degradation (%/yr)+	0.7%/yr
Inflation Rate (%/yr)+	2%/yr
Discount Rate (%/yr)+	5%/yr
Utility Rate Escalation (%/yr)+	4%/yr
Non-Energy Benefit (% of Installation Cost)+	5%
Added Maintenance Cost (%/yr)+	0.20%
Inverter Replacement Interval+	Year 8 and Year 16
Inverter Replacement Cost ($/WAC)+	$0.711/WAC in Year 8, $0.817/WAC in Year 16
System Details	
Number of Panels to be Installed	462
PTC Rating (WDC) of Each Panel	238.8 WDC
Nameplate Inverter Efficiency (%)	96.50%
Inverter Nameplate Rating (kWAC)	93.33 kWAC
PV Rebate from Utility	NONE
Total Project Cost without Rebate ($)	$428,505
Year 1 kWh Production (kWh)*	159,696
Year 1 Avoided Utility Cost ($)*	$35,395
Non-Energy Benefits ($)*	$21,425
Financing Scenario Assumptions	
LTV Ratio (%)	80%
Loan Term (yrs)	20
Interest Rate (%)	4%
O&M Contract Cost (yr 1 $)	$3,060.75
PPA Scenario Assumptions	
Initial PPA Rate ($/kWh)	$0.1600
Annual PPA Rate Escalator (%)	2.50%

+CEC Energy Savings Calculator assumption

*CEC Energy Savings Calculator result

Scenario Analysis Parameters

Conclusion and Recommendation.

The methodology proposed by the California Energy Commission (CEC) for calculating the Savings to Investment Ratio (SIR) for solar Power Purchase Agreements (PPAs) puts solar PPAs at a severe and inequitable disadvantage relative to other energy efficiency and clean energy technologies. This methodology is inappropriate, inconsistent with the treatment of other energy and cost saving measures under Prop 39, and violates the statutes which created and provide direction to the CEC in implementing the Prop 39 program. The CEC's method double-counts the costs of PPAs, resulting in a standard for cost-effectiveness roughly two times higher than what it is for all other eligible energy projects.

Fortunately, the problem described and illustrated herein is easy to fix administratively by changing the SIR_{SPPA} from:

$$SIR_{SPPA} = \frac{NPV\ of\ LEA\ Cost\ Savings\ from\ PPA\ Discount}{NPV\ of\ LEA\ Electricity\ Cost\ Paid\ under\ PPA} \geq 1.05 \qquad \textit{Eq. 9}$$

to:

$$SIR_{SPPA} = \frac{NPV\ of\ LEA\ Electric\ Utility\ Cost\ Savings}{NPV\ of\ LEA\ Electricity\ Cost\ Paid\ under\ PPA} \geq 1.05 \qquad \textit{Eq. 14}$$

This change will correct the problem and ensure that the cost-effectiveness of solar PPA's is measured as the statute intends and in the same manner as other energy efficiency and clean energy technologies.